Center Independent Research & Development: GSFC IRAD

Longitudinal Proximity Effect Superconducting Transition-Edge Sensor (LoPE TES)

Completed Technology Project (2017 - 2018)

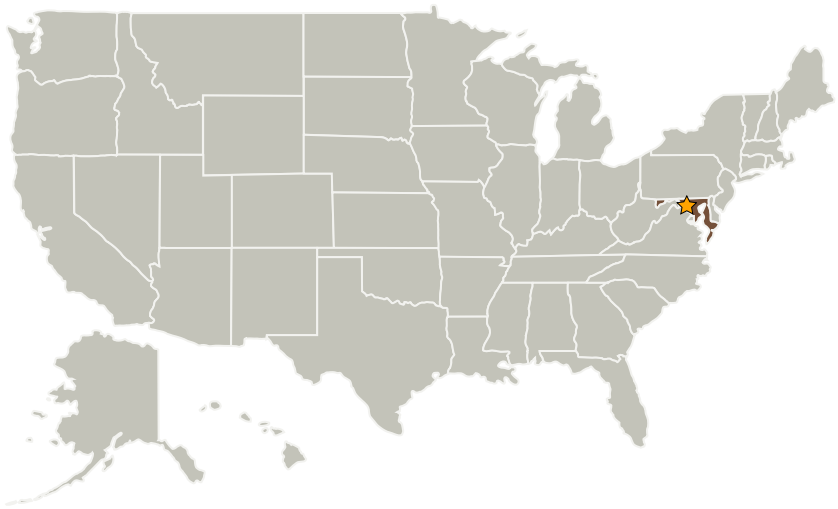
Project Introduction

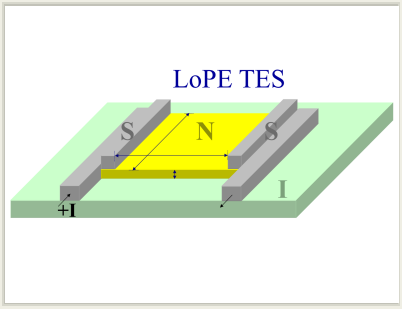
Superconducting Transition-Edge Sensors (TESs) hold the highest energy resolving power of any nondispersive spectrometer. They are used for imaging spectroscopy across the electromagnetic spectrum measuring gamma-rays, X-rays, UV, and optical photons and photon fluxes in the microwave band. A TES microcalorimeter measures the energy of individual photons with high quantum efficiency and without dispersive optics. TESs are "noiseless detectors" in the astronomy sense where they achieve true single photon detection with zero dark counts. The fundamental noise fluctuations in the TES simply limit the measured energy of the photons. In this work we will design and fabricate a new type of TES where the sensor material is not a superconductor at any temperature.

Anticipated Benefits

This proof of principle demonstration will expand the TES materials design space, improving upon the existing state-of-the-art sensitivity and energy resolution. The detectors are designed to be compatible with operation in the nonlinear regime and having their sensitivity *in situ* tunable with an external magnetic field.

Primary U.S. Work Locations and Key Partners





Schematic of a LoPE TES with the thermistor body is a normal metal (N) material connected to superconducting (S) lead materials that carry the bias current in and out of the TES.

Table of Contents

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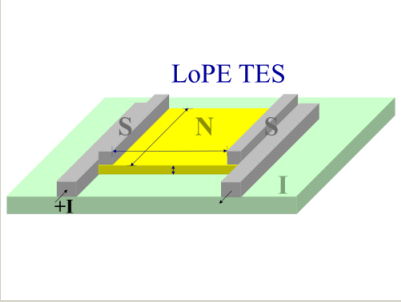
Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations
Maryland

Images



Schematic of a LoPE TES with the thermistor body is a normal metal (N) material connected to superconducting (S) lead materials

Schematic of a LoPE TES with the thermistor body is a normal metal (N) material connected to superconducting (S) lead materials that carry the bias current in and out of the TES.
(https://techport.nasa.gov/image/28291)

Organizational Responsibility

Responsible Mission Directorate:

Mission Support Directorate (MSD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Center Independent Research & Development: GSFC IRAD

Project Management

Program Manager:

Peter M Hughes

Project Managers:

Megan E Eckart
Timothy D Beach
Terry Doiron

Principal Investigator:

John E Sadleir

Co-Investigators:

Peter C Nagler
Bernard J Rauscher
Samuel H Moseley

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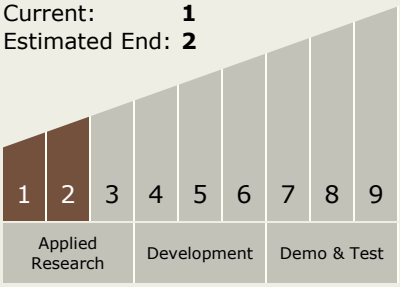
Technology Maturity (TRL)

Start: **1**
Current: **1**
Estimated End: **2**



Technology Areas

Primary:

- TX05 Communications, Navigation, and Orbital Debris Tracking and Characterization Systems
  - TX05.5 Revolutionary Communications Technologies
    - TX05.5.2 Quantum Communications

Target Destinations

Outside the Solar System, Foundational Knowledge

Supported Mission Type

Projected Mission (Pull)